ENHANCEMENT OF HEAT TRANSFER BY THE COMBUSTOR-HEAT EXCHANGER

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The state-of-the-art technology of a combustor-heat exchanger which has the potential to enhance heat transfer in fossil-fired industrial furnaces and equipment is discussed. The combustor-heat exchanger is a combination of a combustor and a heat exchanger in one unit, involving relatively cold heat exchange surfaces (or tubes) embedded in a stationary bed of fibrous material in which a gaseous fuel is burned. A basic experimental approach was conducted on a combustor-heat exchanger with staggered tube bank embedded. The heat transfer mechanism of combined convective-radiative heat transfer and its interaction with the combustion in the porous matrix are discussed through measured thermal structure in terms of temperature profiles, heat transfer characteristics and emission characteristics for the variable parameters of operation. The results demonstrate that the combustor-heat exchanger yields heat transfer potential of about 11 to 20 times larger than that of the heat transfer obtained by a force convection only. The thermal efficiency is increased with the thermal input, whereas the CO emission is significantly decreased. Increasing the equivalence ratio markedly increases the thermal efficiency. Prompt and thermal NO_x formation, which is temperature dependent, can be controlled by the special features of this combustion system that favorable combustion in conjunction with heat transfer characteristic can be achieved, such as appropriate cooling of the combustion zone. Low combustion emission of CO and NO_x, respectively, of less than 200 ppm and 10 ppm were found in the range studied.